REMARKS

In the Office Action, the Examiner objected to claim 66, and rejected claims 1-11, 16-17, 19, 23-33, 35-36, 42-45, 48, 50, 54, 57-65 and 67-68 under 35 USC § 103 and claims 19, 23-25, 28-33, 35-36, 42-45, 48, 54 and 63 under 35 USC § 112. These rejections are fully traversed below.

Claims 1, 19, 50, 66 and 67 have been amended. Claims 69-75 have been added. Thus, claims 1-11, 16-17, 19, 23-33, 35-36, 42-45, 48, 50, 54 and 57-75 are pending in the application. Reconsideration of the application is respectfully requested based on the following remarks.

Claim Objections

Claim 66 has been amended to overcome the rejection. Particularly, "and" has been replaced with "or".

Claim Rejections – 35 USC 112

The rejection should be withdrawn based on the amendments made above. Particularly, the terms "exact" and "identical" have been removed in order to expedite prosecution. Although they these terms have been removed, it is still believed that they are supported by the specification. Examples can be provided if needed in the future.

Claim Rejections – 35 USC 103

As stated throughout prosecution, a prima facie case of obvious has not been made. The Examiner simply has not provided a reason as to why one skilled in the art would modify the cited references to come up with the claimed invention. Again, the Examiner is relying on individual pieces from various references to form the claimed invention without a proper reason. It appears that the Examiner is relying on a high level of skill in the art.

To elaborate, each of the cited references discloses a gas system that should be taken in totality. Pieces should not be taken from one and added to another. Each of these systems is a system and therefore the addition of another element would surely effect the proper functioning

of the system in a non-trivial manner. One skilled in the art would simply not be motivated to combine the teachings of the various components of these systems to come up with the claimed invention. Furthermore, it is believed that the motivation to combine should come from something other than the fact that these are gas systems since each of these gas systems operates in a substantially different manner. Accordingly, the rejections should be withdrawn.

To further strengthen this position, it is pointed out that a majority of the cited references are directed at deposition (e.g., Fujii, Yamazaki, Li (551), Fujiyama, Muregesh). Etching and deposition are two distinctly different processes with different requirements. Pieces from a gas flow system associated with deposition cannot simply be added or combined to a gas flow system associated with etching without some modification. While the cited references may show gas flow systems, they are from a different world of processing where specific gases being used for deposition were known to be highly reactive on the wafer and hence of critical importance by themselves on the resulting performance of the deposition process. This is why you see the prevalence of different gas mixtures introduced at different locations in the chamber. For instance when the depositing gas needs to be ionized or disassociated by the plasma in order to essentially stick and react on the wafer in one bounce, you find multiple gas locations for gas feeds especially split near and far from the wafer or plasma source. This is very different from the present invention, which includes top center and edge (top and/or bottom) arrangements with a single gas mixture.

Moreover, at the time of the invention it was not at all obvious that an etch process that depended on plasma etch processes producing volatile products from the wafer would benefit from dual location gas feeds of the same gas mixture but in varying flow quantities. This lack of obviousness was due to the lack of sensitivity of the then current device geometries and resulting etch profiles and rates to variations in gas flows relative to variations in plasma controlling parameters such as pressure and rf power. Remember that the at the low pressures used for plasma etch, form non-plasma gas mixtures that do not interact strongly with the wafer or chamber walls, hence the neutral gas bounces all over the chamber to equalize the pressure near instantaneously from wherever it is introduced in the chamber. Thus, the plasma resulting from the various flow ratio in the present invention are nearly identical and yet process uniformity control can still be had. At the time though, the conventional wisdom was that it really didn't matter that much where you introduced reactive gasses to the etch chamber, especially if you weren't going to change the gas mixture. What mattered much more was how and where you

deposited power into the plasma and how these charged and excited species diffused to the wafer. This was especially true in plasma etch systems where the electrical forces on the charged species that were most involved in driving the etch process results where a much stronger influence on the uniformity of the plasma and hence the plasma etch results than the neutral dynamics. You can see this concern even in the antenna design, magnetic uniformity control and plasma density control patents that are incorporated by referenced in this application. It was the inventors realization that for advanced etch uniformity control both electromagnetic control of the plasma as well as addition of the subtle gas distribution control would be required and important in the
future which drove the invention.

Accordingly, the rejections should be withdrawn.

Claims 1, 3, 7-10 and 16-17 have been rejected under 35 U.S.C. §103(a) as being unpatentable over *Li* (6,009,830) in view of *Fujii* et al (4,980,204) *or Fujiyama* et al. (4,529,474) or *Yamakazi* (4,105,810).

In contrast to *Li, Fujii, Fujiyama , Yamakazi* claim 1 (and its dependents) specifically requires, " said gas flow system controlling flow of a single input gas comprising a mixture of etchant source gases into at least two different regions of said plasma processing chamber....at least a first portion of said input gas being delivered to said plasma processing chamber via said first outlet and a remaining portion of said input gas being delivered to said plasma processing chamber via said second outlet." As mentioned by the Examiner, *Li 830* does not disclose this limitation thus relying on support from the other references *Fujii, Fujiyama and Yamakazi*. These references, however, also fail to teach or suggest such a limitation.

In *Fujii*, the four vent pipes 111-114 are only located at the top of the reactor chamber 5 and thus gases are not delivered to two different regions. That is, they only deliver to a top region. It should be pointed out that as further required by claim 1 the two different regions include at least a peripheral region and a top region. A peripheral region is simply not taught in *Fujii*. Accordingly, the rejection is unsupported by the art and should be withdrawn.

In *Fujiyama*, the gas emitting tube 4 and gas emitting ring 9 emit different gases and thus the flow of a single gas is not controlled to two different regions. As stated in *Fujiyama*, "silane

gas from a starting gas tank 7 is emitted through a starting gas emitting tube 4 into the reaction chamber (Col. 2, lines 43-45)...a gas mixture of carbon tetrafluoride and oxygen in gas mixture container 8 is introduced into the reaction chamber through an etching gas emitting ring 9 (Col. 2, lines 59-63)." Furthermore, it should be noted that the emission of these two different gases is performed at different times and thus it cannot be the same gas. One is associated with a starting gas feeding system and the other is associated with an etching gas feeding system. Accordingly, the rejection is unsupported by the art and should be withdrawn.

In *Yamakazi,* the gases are only introduced at a top region as shown by Fig. 1 and thus gases are not delivered to two different regions. See *Fujii* above. It should further be pointed out that the exiting gases are not controlled and thus they are not rationized as further required by the claim. Accordingly, the rejection is unsupported by the art and should be withdrawn.

Although the rejections to the dependent claims should be withdrawn for at least the reasons as above, it should be noted that they offer additional language that is unsupported by the art.

Claims 1- 5, 7-10, 16-17, 50, 57, 59, 62 and 67-68 have been rejected under 35 U.S.C. §103(a) as being unpatentable over *Li* (6,070,551) in view of *Fujii* et al (4,980,204) *or* *Fujiyama* et al. (4,529,474) or *Yamakazi* (4,105,810).

In contrast to *Li, Fujii, Fujiyama , Yamakazi* claim 1 (and its dependents) specifically requires, " said gas flow system controlling flow of a single input gas comprising a mixture of etchant source gases into at least two different regions of said plasma processing chamber....at least a first portion of said input gas being delivered to said plasma processing chamber via said first outlet and a remaining portion of said input gas being delivered to said plasma processing chamber via said second outlet." As mentioned by the Examiner, *Li 551* does not disclose this limitation thus relying on support from the other references *Fujji, Fujiyama and Yamakazi.* These references, however, also fail to teach or suggest such a limitation.

In *Fujii,* the four vent pipes 111-114 are only located at the top of the reactor chamber 5 and thus gases are not delivered to two different regions. That is, they only deliver to a top region. It should be pointed out that as further required by claim 1 the two different regions

include at least a peripheral region and a top region. A peripheral region is simply not taught in *Fujii*. Accordingly, the rejection is unsupported by the art and should be withdrawn.

In *Fujiyama*, the gas emitting tube 4 and gas emitting ring 9 emit different gases and thus the flow of a single gas is not controlled to two different regions. As stated in *Fujiyama*, "silane gas from a starting gas tank 7 is emitted through a starting gas emitting tube 4 into the reaction chamber (Col. 2, lines 43-45)...a gas mixture of carbon tetrafluoride and oxygen in gas mixture container 8 is introduced into the reaction chamber through an etching gas emitting ring 9 (Col. 2, lines 59-63)." Furthermore, it should be noted that the emission of these two different gases is performed at different times and thus it cannot be the same gas. One is associated with a starting gas feeding system and the other is associated with an etching gas feeding system. Accordingly, the rejection is unsupported by the art and should be withdrawn.

In *Yamakazi*, the gases are only introduced at a top region as shown by Fig. 1 and thus gases are not delivered to two different regions. See *Fujii* above. It should further be pointed out that the exiting gases are not controlled and thus they are not rationized as further required by the claim. Accordingly, the rejection is unsupported by the art and should be withdrawn.

In contrast to *Li, Fujii, Fujiyama , Yamakazi*, claim 50 (and its dependents) specifically requires, "...a plurality of outlets arranged to deliver the same said input gas to different locations within said plasma process chamber, a first outlet being configured to deliver said input gas to said first output, a second outlet being configured to deliver said input gas to said second output, said gas flow controller directing at the same time varying amounts of said input gas to each of said first and second outputs so as to provide better process control, a first portion of the total flow of the input gas being delivered through the first outlet to the first output, and a remaining portion of the total flow of the input gas being delivered through the second outlet to the second output." In *Li*, different gases (NOT the same gas as required by the claim) are fed individually into different portions of the chamber. This allows an operator to deliver different mixtures into the process chamber.

Li states, "In this embodiment, the present invention preferably supplies a combination of SiF4 and oxygen from first gas source for introduction into chamber 18 through orifices 38 of nozzles 34...Silane (SiH4) is preferably delivered into chamber 18 from second gas source 35a through second gas controller 37a and through nozzles 34a. In addition, third gas source 58 is

preferably used to introduce silane (or for example a mixture of silane and SiF4) into chamber 18 from above substrate 20. In conjunction with this, oxygen is also directed into chamber 18 from position above substrate 20, but along a flow path separate from the flow path of the silane through pathway 70 and annular orifice 76 (Col. 5, lines14-27)."

Again, it should be emphasized that the present invention simultaneously feeds a single mixture to different regions of the process chamber. As a result, the same mixture is always being delivered to the different regions. The total gas flow at the inlet is equal to the sum of the gas flow at the outlets. This is simply not done in *Li*.

Fujii, Fujiyama and Yamaguchi do not overcome the deficiencies of *Li*. In *Fujii*, the four vent pipes 111-114 are only located at the top of the reactor chamber 5 and thus gases are not delivered to two different regions. In *Fujiyama*, the gas emitting tube 4 and gas emitting ring 9 emit different gases and thus the flow of a single gas is not controlled to two different regions. In *Yamakazi*, the gases are only introduced at a top region and the exiting gases are not controlled and thus they are not rationized. Accordingly, the rejection is unsupported by the art and should be withdrawn.

Although the rejections to the dependent claims should be withdrawn for at least the reasons as above, it should be noted that they offer additional language that is unsupported by the art.

Claims 1- 5, 7-9, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 50, 54 and 67-68 have been rejected under 35 U.S.C. §103(a) as being unpatentable over *Collins* et at (6,024,826) in view of *Fujii* et al (4,980,204) *or Fujiyama* et al. (4,529,474) or *Yamakazi* (4,105,810).

In contrast to *Collins, Fujii, Fujiyama , Yamakazi* claim 1 (and its dependents) specifically requires, " said gas flow system controlling flow of a single input gas comprising a mixture of etchant source gases into at least two different regions of said plasma processing chamber....at least a first portion of said input gas being delivered to said plasma processing chamber via said first outlet and a remaining portion of said input gas being delivered to said plasma processing chamber via said second outlet." As mentioned by the Examiner, *Collins* does not disclose this limitation thus relying on support from the other references *Fujji*,

Fujiyama and Yamakazi. These references, however, also fail to teach or suggest such a limitation.

In *Fujii*, the four vent pipes 111-114 are only located at the top of the reactor chamber 5 and thus gases are not delivered to two different regions. That is, they only deliver to a top region. It should be pointed out that as further required by claim 1 the two different regions include at least a peripheral region and a top region. A peripheral region is simply not taught in *Fujii*. Accordingly, the rejection is unsupported by the art and should be withdrawn.

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In *Yamakazi*, the gases are only introduced at a top region as shown by Fig. 1 and thus gases are not delivered to two different regions. See *Fujii* above. It should further be pointed out that the exiting gases are not controlled and thus they are not rationized as further required by the claim. Accordingly, the rejection is unsupported by the art and should be withdrawn.

In contrast to *Collins, Fujii, Fujiyama , Yamakazi*, claim 19 (and its dependents) specifically requires, "...said gas flow system separating and directing the flow of the same single input gas, associated with forming a plasma, at the same time into at least two different regions of said plasma processing chamber, said at least two different regions ... at least a first portion of said input gas being delivered to said upper peripheral region and a remaining portion of said input gas being delivered to said top central region..." As mentioned by the Examiner, *Collins* does not disclose this limitation thus relying on support from the other references *Fujji, Fujiyama and Yamakazi*. These references, however, also fail to teach or suggest such a limitation (see above).

Also in contrast to all these references, claim 19 specifically requires, "...an azimuthally symmetric gas distribution system comprising at least a gas ring that supplies a portion of said single input gas to the upper peripheral region, the gas ring including a series of holes substantially equidistant about the periphery of the gas ring." No such feature is taught in any of the references. Accordingly, the rejection is unsupported by the art and should be withdrawn.

In contrast to all the references, claim 50 (and its dependents) specifically requires, "...a plurality of outlets arranged to deliver the same said input gas to different locations within said plasma process chamber, a first outlet being configured to deliver said input gas to said first output, a second outlet being configured to deliver said input gas to said second output, said gas flow controller directing at the same time varying amounts of said identical input gas to each of said first and second outputs so as to provide better process control, a first portion of the total flow of the input gas being delivered through the first outlet to the first output, and a remaining portion of the total flow of the input gas being delivered through the second outlet to the second output." In *Collins*, different gases (NOT the same gas as required by the claim) are fed individually into different portions of the chamber. This allows an operator to deliver different mixtures into the process chamber.

As shown in the various Figures of *Collins* as for example Fig. 8, *Collins* shows seven independent gas supplies. Although the independent gas supplies may supply similar gases they do not deliver the same gas since they are independent of one another. Furthermore, *Collins* also fails to teach or suggest rationing to different regions. That is, *Collins* does not teach adjusting the amount of the input gas that is delivered to each of said first and second outputs.

Again, it should be emphasized that the present invention simultaneously feeds a single mixture to different regions of the process chamber. As a result, the same mixture is always being delivered to the different regions. The total gas flow at the inlet is equal to the sum of the gas flow at the outlets. This is simply not done in *Collins*.

Fujii, Fujiyama and Yamaguchi do not overcome the deficiencies of *Collins*. In *Fujii*, the four vent pipes 111-114 are only located at the top of the reactor chamber 5 and thus gases are not delivered to two different regions. In *Fujiyama*, the gas emitting tube 4 and gas emitting ring 9 emit different gases and thus the flow of a single gas is not controlled to two different regions. In *Yamakazi*, the gases are only introduced at a top region and the exiting gases are not

controlled and thus they are not rationized. Accordingly, the rejection is unsupported by the art and should be withdrawn.

Although the rejections to the dependent claims should be withdrawn for at least the reasons as above, it should be noted that they offer additional language that is unsupported by the art.

Claims 1- 5, 7-10, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 54, 57, 59 and 62 have been rejected under 35 U.S.C. §103(a) as being unpatentable over *Muregesh* et at (6,228,781) in view of *Fujii* et al (4,980,204) *or Fujiyama* et al. (4,529,474) or *Yamakazi* (4,105,810).

In contrast to *Muregesh, Fujii, Fujiyama , Yamakazi,* claim 1 (and its dependents) specifically requires, " said gas flow system controlling flow of a single input gas comprising a mixture of etchant source gases into at least two different regions of said plasma processing chamber....at least a first portion of said input gas being delivered to said plasma processing chamber via said first outlet and a remaining portion of said input gas being delivered to said plasma processing chamber via said second outlet." As mentioned by the Examiner, *Muregesh* does not disclose this limitation thus relying on support from the other references *Fujji, Fujiyama and Yamakazi.* These references, however, also fail to teach or suggest such a limitation.

In *Fujii,* the four vent pipes 111-114 are only located at the top of the reactor chamber 5 and thus gases are not delivered to two different regions. That is, they only deliver to a top region. It should be pointed out that as further required by claim 1 the two different regions include at least a peripheral region and a top region. A peripheral region is simply not taught in *Fujii.* Accordingly, the rejection is unsupported by the art and should be withdrawn.

In *Fujiyama,* the gas emitting tube 4 and gas emitting ring 9 emit different gases and thus the flow of a single gas is not controlled to two different regions. As stated in *Fujiyama,* "silane gas from a starting gas tank 7 is emitted through a starting gas emitting tube 4 into the reaction chamber (Col. 2, lines 43-45)...a gas mixture of carbon tetrafluoride and oxygen in gas mixture container 8 is introduced into the reaction chamber through an etching gas emitting ring 9 (Col. 2, lines 59-63)." Furthermore, it should be noted that the emission of these two different gases is performed at different times and thus it cannot be the same gas. One is associated with a starting

gas feeding system and the other is associated with an etching gas feeding system. Accordingly, the rejection is unsupported by the art and should be withdrawn.

In *Yamakazi*, the gases are only introduced at a top region as shown by Fig. 1 and thus gases are not delivered to two different regions. See *Fujii* above. It should further be pointed out that the exiting gases are not controlled and thus they are not rationized as further required by the claim. Accordingly, the rejection is unsupported by the art and should be withdrawn.

In contrast to *Muregesh, Fujii, Fujiyama , Yamakazi*, claim 19 (and its dependents) specifically requires, "...said gas flow system separating and directing the flow of the same single input gas, associated with forming a plasma, at the same time into at least two different regions of said plasma processing chamber, said at least two different regions ... at least a first portion of said input gas being delivered to said upper peripheral region and a remaining portion of said input gas being delivered to said top central region..." As mentioned by the Examiner, *Muregesh* do not disclose this limitation thus relying on support from the other references *Fujji, Fujiyama and Yamakazi*. These references, however, also fail to teach or suggest such a limitation (see above).

Also in contrast to all these references, claim 19 specifically requires, "...an azimuthally symmetric gas distribution system comprising at least a gas ring that supplies a portion of said single input gas to the upper peripheral region, the gas ring including a series of holes substantially equidistant about the periphery of the gas ring." No such feature is taught in any of the references. Accordingly, the rejection is unsupported by the art and should be withdrawn.

In contrast to all the references, claim 50 (and its dependents) specifically requires, "...a plurality of outlets arranged to deliver the same said input gas to different locations within said plasma process chamber, a first outlet being configured to deliver said input gas to said first output, a second outlet being configured to deliver said input gas to said second output, said gas flow controller directing at the same time varying amounts of said input gas to each of said first and second outputs so as to provide better process control, a first portion of the total flow of the input gas being delivered through the first outlet to the first output, and a remaining portion of the total flow of the input gas being delivered through the second outlet to the second output." In *Muregesh*, different gases (NOT the same gas as required by the claim) are fed individually into

different portions of the chamber. This allows an operator to deliver different mixtures into the process chamber.

Again, it should be emphasized that the present invention simultaneously feeds a single mixture to different regions of the process chamber. As a result, the same mixture is always being delivered to the different regions. The total gas flow at the inlet is equal to the sum of the gas flow at the outlets. This is simply not done in *Li or Collins*.

Fujii, Fujiyama and Yamaguchi do not overcome the deficiencies of *Li* and *Collins*. In *Fujii*, the four vent pipes 111-114 are only located at the top of the reactor chamber 5 and thus gases are not delivered to two different regions. In *Fujiyama*, the gas emitting tube 4 and gas emitting ring 9 emit different gases and thus the flow of a single gas is not controlled to two different regions. In *Yamakazi*, the gases are only introduced at a top region and the exiting gases are not controlled and thus they are not rationized. Accordingly, the rejection is unsupported by the art and should be withdrawn.

Although the rejections to the dependent claims should be withdrawn for at least the reasons as above, it should be noted that they offer additional language that is unsupported by the art.

Claim 6 has been rejected under 35 U.S.C. §103(a) as being unpatentable over *Li* et al. (6,070,551) in view of *Fujii* et al. (4,980,204) *or Fujiyama* et al. (4,529,474) or *Yamakazi* (4,105,810) as applied to claims 1-5, 7-10, 16-17, 50, 57, 59 and 62 above and further in view of *Wing* et al (6,277,235).

Claims 6 and 36 have been rejected under 35 U.S.C. §103(a) as being unpatentable over *Collins* et al. (6,024,826) in view of *Fujii* et al. (4,980,204) *or Fujiyama* et al. (4,529,474) or *Yamakazi* (4,105,810) as applied to claims 1-5, 7-9, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 50 and 54 above and further in view of *Wing* et al. (6,277,235).

Claims 6 and 36 have been rejected under 35 U.S.C. §103(a) as being unpatentable over *Muregesh* et al. (6,228,781) in view of *Fujii* et al. (4,980,204) *or Fujiyama* et al. (4,529,474) or *Yamakazi* (4,105,810) as applied to claims 1- 5, 7-10, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 54, 57, 59 and 62 above and further in view of *Wing* et al. (6,277,235).

Wing does not cure the deficiencies of the cited art. All of the references fail to teach or suggest a gas flow system that controls the flow of a single input gas comprising a mixture of etchant source gases into at least two different regions of a plasma processing chamber. Accordingly, the rejection is unsupported by the art and should be withdrawn.

Furthermore, claim 6 specifically requires, "...wherein the input gas is released through the chuck." *Li, Murugesh and Collins* are all silent to introducing a gas through a chuck (as indicated by the Examiner in the outstanding office action). And while *Wing* may disclose aperture 8 centrally located in the surface of the chuck 106, *Wing* does not teach or suggest flowing a source gas suitable for use to etch the substrate in the processing chamber 100 through the aperture 108. In *Wing*, gas such as He is supplied to the backside of the substrate from gas source 118 and aperture 108 to improve heat transfer and control substrate backside deposition (see Col. 3, lines 49-55). Accordingly, the rejection is unsupported by the art and should be withdrawn.

Similar arguments can be made for claim 36.

Claims 45 has been rejected under 35 U.S.C. §103(a) as being unpatentable over *Muregesh* et al. (6,228,781) in view of *Fujii* et al. (4,980,204) *or Fujiyama* et al. (4,529,474) or *Yamakazi* (4,105,810) as applied to claims 1- 5, 7-10, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 54, 57, 59 and 62 above and further in view of *Ueda* et al. (5,810,932) and *Kadomura* (6,096,160).

Claims 45 has been rejected under 35 U.S.C. §103(a) as being unpatentable over *Collins* et al. (6,024,826) in view of *Fujii* et al. (4,980,204) *or Fujiyama* et al. (4,529,474) or *Yamakazi* (4,105,810) as applied to claims 1-5, 7-9, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 50 and 54 above and further in view of *Ueda* et al. (5,810,932) and *Kadomura* (6,096,160).

The rejections to claim 45 should be withdrawn for at least the same reasons as above. That is, *Ueda* and *Kadomura* do not overcome the deficiencies of *Murugesh or Collins* and further *Fujii, Fujiyama and Yamakazi*. None of these references teaches or suggests the features described above with regard to claims 19 from which claim 45 depends.

Claims 10 and 57-65 have been rejected under 35 U.S.C. §103(a) as being unpatentable over *Collins* et al. (6,024,826) in view of *Fujii* et al. (4,980,204) *or Fujiyama* et al. (4,529,474) or *Yamakazi* (4,105,810) as applied to claims 1- 5, 7-9, 16-17, 19, 23-25, 28-33, 35, 42-44, 46, 48, 50 and 54 above and further in view of *Li* (6,070,551).

The rejections to these claims should be withdrawn for at least the same reasons as above. That is, *Li* does not overcome the deficiencies of *Collins* and further *Fujji, Fujiyama and Yamakazi*. None of these references teaches or suggests the features described above with regard to claim 1 from which these claims depend.

In addition, none of the references teach or suggest, "wherein said plasma processing system further comprises a gas delivery ring that is fluidly coupled to said first outlet, and positioned on an upper portion of the plasma processing chamber, the gas delivery ring including a series of holes substantially equidistant about the periphery of the gas delivery ring, the first portion of said input gas being delivered into said upper peripheral region of said plasma processing chamber through said series of holes," as required by claim 10.

Also in contrast to all the references, claim 57 specifically requires, "...an azimuthally symmetric gas distribution system ... the first gas outlet supplying said first portion of said input gas to the gas channel, the gas channel equally distributing the first portion of said input gas through each of the holes in the gas delivery ring, and the holes feeding the first portion of said input gas into the upper peripheral region of the process chamber." It appears that no such feature is taught in any of the cited references, and therefore the rejection should be withdrawn.

Also in contrast to all the references, claim 58 specifically requires, "...wherein the azimuthally symmetric gas distribution system further includes a gas distribution plate that supplies the remaining portion of said single input gas to the top central region, the gas distribution plate having a pattern of holes, the gas distribution plate being fluidly coupled to the second gas outlet." No such feature, and further no such feature in combination with the features of claim 57 from which claim 58 depends is taught in any of the cited references. Accordingly, the rejection is unsupported by the art and should be withdrawn.

Also in contrast to all the references, claim 59 specifically requires, "...wherein gas delivery ring includes 16 holes configured an equal distance from each other." It appears that none of the references teach or suggest releasing gas from a ring that contains 16 holes, which are positioned an equal distance from each other. Accordingly, the rejection is unsupported by the art and should be withdrawn.

Also in contrast to all the references, claim 60 specifically requires, "...a vacuum plate positioned above the inner wall of the plasma processing chamber, the vacuum plate cooperating with the plasma processing chamber to form a processing region above the substrate, the vacuum plate including an opening at its center, the opening in the vacuum plate being fluidly coupled to the second outlet; and

a gas delivery ring provided between the vacuum plate and an upper surface of the inner wall, the gas delivery ring having a series of holes substantially equidistant about the periphery of the gas delivery ring, the series of holes being fluidly coupled to the first outlet, and being placed near the vacuum plate, and

wherein the first portion of the input gas is supplied to the upper peripheral region of the plasma processing chamber via the holes in the gas delivery ring, and wherein the remaining portion of the input gas is supplied to the top central region of the plasma processing chamber via the opening in the vacuum plate." Accordingly, the rejection is unsupported by the art and should be withdrawn.

Also in contrast to all the references, claim 61 specifically requires, "...wherein a seal is provided between the gas delivery ring and the vacuum plate and between the upper surface of the inner walls and the gas delivery ring." It appears that each of the references is silent to seals located between a vacuum plate, which is positioned above the inner wall and a gas delivery ring, which is located between the vacuum plate and the inner wall. Accordingly, the rejection is unsupported by the art and should be withdrawn.

Also in contrast to all the references, claim 62 specifically requires, "...wherein the top central region is located directly above the substrate to be processed, and the upper peripheral

region is located along the inner walls of the plasma processing chamber near the top central region." Accordingly, the rejection is unsupported by the art and should be withdrawn.

Also in contrast to all the references, claim 63 specifically requires, "...wherein the first output corresponds to a gas distribution plate having a pattern of holes, and wherein the second output corresponds to a gas ring having a series of holes substantially equidistant about the periphery of the gas ring." Accordingly, the rejection is unsupported by the art and should be withdrawn.

Also in contrast to all the references, claim 64 specifically requires, "...wherein the first output is vacuum plate having a centrally located opening, and wherein the second output is a gas ring having a series of holes substantially equidistant about the periphery of the gas ring." Accordingly, the rejection is unsupported by the art and should be withdrawn.

Also in contrast to all the references, claim 65 specifically requires, "...wherein gas ring is located next to the vacuum plate." Accordingly, the rejection is unsupported by the art and should be withdrawn.

Moreover, it is believed that one skilled in the art would not be motivated to combine *Collins* with *Li* in order to produce the claimed invention. As shown in Fig. 18, 164b is positioned in a sloped or domed section of the chamber. This would make it extremely difficult to use a gas ring. Accordingly, the rejection should be withdrawn.

Claims 58, 60-61 and 63-65 have been rejected under 35 U.S.C. §103(a) as being unpatentable over *Li* et al. (6,070,551) in view of *Fujii* et al. (4,980,204) *or Fujiyama* et al. (4,529,474) or *Yamakazi* (4,105,810) as applied to claims 1-5, 7-10, 16-17, 50, 57, 59 and 62 above and further in view of *Li* (6,009,830).

The rejections to these claims should be withdrawn for at least the same reasons as above. That is, *Li* does not overcome the deficiencies of *Li* and further *Fujji, Fujiyama and Yamakazi.* None of these references teaches or suggests the features described above with regards to claim 1 from which these claims depend.

Also in contrast to all the references, claim 58 specifically requires, "...wherein the azimuthally symmetric gas distribution system further includes a gas distribution plate that supplies the remaining portion of said single input gas to the top central region, the gas distribution plate having a pattern of holes, the gas distribution plate being fluidly coupled to the second gas outlet." No such feature, and further no such feature in combination with the features of claim 57 from which claim 58 depends is taught in any of the cited references. Accordingly, the rejection is unsupported by the art and should be withdrawn.

Also in contrast to all the references, claim 60 specifically requires, "...a vacuum plate positioned above the inner wall of the plasma processing chamber, the vacuum plate cooperating with the plasma processing chamber to form a processing region above the substrate, the vacuum plate including an opening at its center, the opening in the vacuum plate being fluidly coupled to the second outlet; and

a gas delivery ring provided between the vacuum plate and an upper surface of the inner wall, the gas delivery ring having a series of holes substantially equidistant about the periphery of the gas delivery ring, the series of holes being fluidly coupled to the first outlet, and being placed near the vacuum plate, and

wherein the first portion of the input gas is supplied to the upper peripheral region of the plasma processing chamber via the holes in the gas delivery ring, and wherein the remaining portion of the input gas is supplied to the top central region of the plasma processing chamber via the opening in the vacuum plate." It appears that no such combination is taught in any of the references and therefore the rejection is unsupported by the art and should be withdrawn.

Also in contrast to all the references, claim 61 specifically requires, "...wherein a seal is provided between the gas delivery ring and the vacuum plate and between the upper surface of the inner walls and the gas delivery ring." It appears that each of the references is silent to seals located between a vacuum plate, which is positioned above the inner wall and a gas delivery ring, which is located between the vacuum plate and the inner wall. Accordingly, the rejection is unsupported by the art and should be withdrawn.

Also in contrast to all the references, claim 63 specifically requires, "...wherein the first output corresponds to a gas distribution plate having a pattern of holes, and wherein the second

output corresponds to a gas ring having a series of holes substantially equidistant about the periphery of the gas ring." It appears that no such arrangement is taught in any of the references and therefore the rejection is unsupported by the art and should be withdrawn.

Also in contrast to all the references, claim 64 specifically requires, "...wherein the first output is vacuum plate having a centrally located opening, and wherein the second output is a gas ring having a series of holes substantially equidistant about the periphery of the gas ring." It appears that no such arrangement is taught in any of the references and therefore the rejection is unsupported by the art and should be withdrawn.

Also in contrast to all the references, claim 65 specifically requires, "...wherein gas ring is located next to the vacuum plate." It appears that no such arrangement is taught in any of the references and therefore the rejection is unsupported by the art and should be withdrawn.

Claims 58, and 60-61 have been rejected under 35 U.S.C. §103(a) as being unpatentable over *Muregesh* et al. (6,228,781) in view of *Fujii* et al. (4,980,204) *or Fujiyama* et al. (4,529,474) or *Yamakazi* (4,105,810) as applied to claims 1- 5, 7-10, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 54, 57, 59 and 62 above and further in view of *Li* (6,009,830).

The rejections to these claims should be withdrawn for at least the same reasons as above. That is, *Li* does not overcome the deficiencies of *Muregesh* and further *Fujji, Fujiyama and Yamakazi*. None of these references teaches or suggests the features described above with regard to claim 1 from which these claims depend.

Also in contrast to all the references, claim 58 specifically requires, "...wherein the azimuthally symmetric gas distribution system further includes a gas distribution plate that supplies the remaining portion of said single input gas to the top central region, the gas distribution plate having a pattern of holes, the gas distribution plate being fluidly coupled to the second gas outlet." No such feature, and further no such feature in combination with the features of claim 57 from which claim 58 depends is taught in any of the cited references. Accordingly, the rejection is unsupported by the art and should be withdrawn.

Also in contrast to all the references, claim 60 specifically requires, "...a vacuum plate positioned above the inner wall of the plasma processing chamber, the vacuum plate cooperating with the plasma processing chamber to form a processing region above the substrate, the vacuum plate including an opening at its center, the opening in the vacuum plate being fluidly coupled to the second outlet; and

a gas delivery ring provided between the vacuum plate and an upper surface of the inner wall, the gas delivery ring having a series of holes substantially equidistant about the periphery of the gas delivery ring, the series of holes being fluidly coupled to the first outlet, and being placed near the vacuum plate, and

wherein the first portion of the input gas is supplied to the upper peripheral region of the plasma processing chamber via the holes in the gas delivery ring, and wherein the remaining portion of the input gas is supplied to the top central region of the plasma processing chamber via the opening in the vacuum plate." It appears that no such combination is taught in any of the references and therefore the rejection is unsupported by the art and should be withdrawn.

Also in contrast to all the references, claim 61 specifically requires, "...wherein a seal is provided between the gas delivery ring and the vacuum plate and between the upper surface of the inner walls and the gas delivery ring." It appears that each of the references is silent to seals located between a vacuum plate, which is positioned above the inner wall and a gas delivery ring, which is located between the vacuum plate and the inner wall. Accordingly, the rejection is unsupported by the art and should be withdrawn.

New Claims

In contrast to all the references, claim 69 specifically requires, "... a single source of input gas, the input gas comprising a mixture of etchant source gases; a gas flow controller for adjusting the amounts and splitting the input gas into at least a first portion and a remaining portion, each portion having the same mixture of etchant source gases because the gas is split..."

In contrast to all the references, claim 69 specifically requires, "...the mixture of etchant source gases remaining the same while traveling through the first and second conduits from the

gas flow controller to the first and second gas outlets such that the same mixture of etchant source gases is outputted by the first and second gas outlets into the process chamber..."

In contrast to all the references, claim 69 specifically requires, "...wherein the gas flow controller is configured to adjust the gas flow rates of the first and remaining portions in order to control the distribution of neutral plasma components inside the process chamber thereby improving the results of the etching task that is being performed inside the process chamber."

In contrast to all the references, claim 70 specifically requires, "...a gas input means configured to deliver a single input gas comprising a mixture of etchant source gases to different locations of the process chamber in order to control the distribution of neutral components inside the process chamber..."

In contrast to all the references, claim 70 specifically requires, "...the gas input means adjusting the time that the neutral components spend in different zones of the process chamber by varying the amount of input gas that is delivered to the different locations of the process chamber, the different zones of the process chamber including at least a hot zone where the input gases are excited..."

The dependent claims 71-74 should be withdrawn for at least the reasons as above with regards to the independent claims.

Other Arguments

The arguments presented in the previous response are still believed to be pertinent and are therefore reproduced below:

Opening Remarks

Although the Applicants appreciate the amount of work the Examiner has done in putting together a 27 page office action that uses at least 8 references with over 36 different combinations, it should be noted that in all of this work the Examiner has failed to provide an ample reason or suggestion as to why one of ordinary skill in the art would

combine the references. In the absence of such a reason or suggestion, the prima facie case of obviousness has failed. It should be emphasized that when the prior art itself provides no apparent reason for one of ordinary skill in the art to make a modification or to combine references, an argument clearly and properly exists that the claimed subject matter would not have been obviousness. Up to this point, the Examiner has failed to provide any evidence that the prior art itself teaches or suggests a combination, i.e., there is no motivation to combine. It appears that the Examiner is relying on a high level of skill in the art in order to provide the necessary motivation. However, if such a rote invocation could suffice to supply a motivation to combine, the more sophisticated scientific fields such as semiconductor processing would rarely, if ever, experience a patentable technical advance.

More particularly, it appears that the Examiner has fallen victim to hindsight syndrome where that which is only taught in the invention is used against the teacher. The Federal Circuit has repeatedly warned against using the applicant's disclosure as a blueprint to reconstruct the claimed invention out of isolated teachings in the prior art. See e.g., Grain Processing Corp. v. American Maize-Products, 840 F.2d 902, 907, 5 USPQ2d 1788, 1792 (fed. Cir. 1988)

Furthermore, it appears that the Examiner has identified individual parts in the prior art, and is relying on those parts to form her rejection. It should be noted, however, that although every element of a claimed invention may often be found in the prior art (which may or may not be the case here), the identification in the prior art of each individual part claimed is insufficient to defeat patentability of the whole claimed invention. Rather, to establish obviousness based on a combination of elements disclosed in the prior art, there must be some motivation, suggestion or teaching of the desirability of making the specific combination that was made by the applicant. See In re Kotzab, 217 F.3d 1365, 55USPQ2d 1313 (Fed. Cir. 2000).

Because of the large number of references and large number of combinations, it appears that the Examiner has copied and pasted the same motivation for each combination to save time. It is shown below:

Therefore, in view of the disclosure, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to modify the apparatus of (Li, Li, Collins, or Muregesh) to comprise the claimed gas inlet structure, because in such a way the same gas (or mixture of gases) can be introduced to the chamber through the different regions (Fujii, Fujiyama, Yamazaki).

As can be seen, the Examiner provides no teaching or suggestion as to why one skilled in the art would combine the references. The Examiner only relies on individual parts taught in the various references. As stated above, and as taught in the courts, identification in the prior art of each individual part claimed is insufficient to defeat the patentability of the whole claimed invention. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. See In re Mills, 916 F.2d 680, 16 USPQ2d 1430 (fed. Cir. 1990).

Although the secondary references may teach useful gas systems, there is no teaching or suggestion that one should use these gas systems, out of countless gas systems, as a gas system for use in another gas system. The Examiner is respectfully urged to provide ample motivation or withdraw the rejections.

Further, with regards to "at the time the invention was made", it should be pointed out that at the time the invention was filed, the inventors believed that the concept of obtaining beneficial wafer results by splitting a mixed gas and delivering it to two different areas of a process chamber was not at all obvious. At the time, there were other non-uniformities in etch systems that appeared due to other causes and conventional wisdom was not to waste time on gas distribution but rather to concentrate engineering efforts on the other areas of non-uniformity. The inventors, however, felt strongly that it was worth creating a dual gas feed in anticipation of eliminating gas related non uniformities and also to provide better control over the process. They were also concerned about small gas flow changes in the standard recipes and thus they decided it was important to deliver the same gas mixture to the different areas of the chamber. The inventors were focused on dielectric etch applications where the subtle interplay between etchant gasses, plasma and neutral, side wall etch inhibitors and there precursors were all playing a subtle role in determining sub micron feature size, profiles, rates and selectivities.

There was quite a lot of concern that given the transformer coupled plasma that the inventors were predominantly using that any feed location effects would be quickly equilibrated through gas diffusion. A standard argument at the time of the invention was also that the introduction of gases in different regions – especially regions near the plasma source such as the top central and upper peripheral would have little effect on the wafer because of the plasma effects (ionization, charge exchange, plasma diffusion, etc) in addition to the gas diffusion prior to hitting the wafer. It was anticipated that various plasma excited species dominated the reactions and results on the wafer and hence the dual gas would be of little use and hence not tried. If gases were to affect the etch process, it was often thought that the gases effect would need to be very strong such as a

strong depositor or strong etchant delivered very close to the wafer to affect any change. The inventors found this not to be the case.

Some advantages, which may or may not have been brought to light before, will now be described. For one, the idea of premixed gases with a controllable split enables the split to be quickly and variably changed during the process while ensuring the same gas is delivered to at least two different regions. For another, the means of this control also provided measurement validation that flows were actually delivered (as opposed to depending on pressure drops by vacuum components). Moreover, if you premix as opposed to split and then mix, you have far fewer valves to implement the split without giving up control. As should be appreciated, large numbers of valves drive up costs and create a more complex system which is harder to control. Furthermore, the present invention does not mix gases after the split to ensure the exact same gas is being outputted to the different regions. As should be appreciated, mixing after splitting causes differences in flow ratios even if separate controllers are set to provide the same flow ratio. The difference may be caused by length of the pipe, the number of bends, the geometry of the bends, etc.

Based on the above, it is believed that all the rejections should be withdrawn.

Response to Examiners Arguments

The Applicants disagree with the Examiner concerning azimuthal symmetry is a matter of choice. The Examiner is relying on a high level of skill in the art and has failed to provide a reference that teaches azimuthal symmetry and its benefits.

The Applicants also disagree with the Examiner concerning substantially identical gases can be distributed to different regions using computer automated technology. Gases simply are not identical unless they come from the same source, further that they are premixed before they are distributed, and further yet that they are not altered during delivery. No matter how good the computer system is, the gases will have subtle differences. Again, the inventors came up with this idea to reduce or eliminate small differences. Any differences, however subtle, will affect sub micron feature sizes, profiles, rates and selectivities in a non-trivial manner. And because of this, the advantage of delivering identical gases to the process chamber cannot be discounted. The Examiner is respectfully urged to point where in the prior art this is taught or withdraw the rejection.

With regard to the Examiners statement "even when one source is used, the composition of the gas can fluctuate over a given time period," the Applicants would like to point out

that one of the advantage of the invention is that no matter what the source supplies, the gases being distributed inside the chamber at each location are identical. Even if the source were to fluctuate, the gases being delivered at any point in time would be the same. This is an important aspect of the invention.

The Applicants disagree with the Examiners assertion that the references were attacked individually. The Examiner is respectfully requested to show where such an attack was made. While the Applicants may have summarized each piece of prior art separately, when it came to arguing the merits, the references were attacked together. On a similar note, it is requested that the Examiner not attack the claimed invention with individual parts from disparate references.

Summary of Cited Art

The present invention is part of a group of applications (all of which are incorporated by reference) directed at azimuthally symmetric processing. It is believed that azimuthally symmetric processing provides better control and more uniform processing at the surface of the substrate. With regard to the present invention described herein, a gas flow system is configured to carry and distribute the same gas mixture (from the same source) to different outlets, and to control the amount of gas through each of the outlets. The invention allows a set single gas mixture with a single sum total flow (sccm) to be split or rationized to multiple portions of the chamber. By rationizing the gas at different regions, the gas may be distributed more evenly inside the process chamber (which as a result can produce more uniform results across the surface of the substrate). Furthermore, the gas mixture being delivered to each region is the same (e.g., from the same source) thereby reducing variations caused by delivering a different gas mixture to each of the regions. It should be noted that even if two independent gas supplies used the same recipe to produce the same gas mixture, there would be differences in the outputted gas mixture (different independent gas sources cannot make exactly the same gas). These differences lead to process variations. Further still, the gas being delivered to each region is symmetrically distributed in each region. For example, a gas ring having a series of holes substantially equidistant about the periphery of the ring or a gas distribution plate with symmetrically patterned holes can be used.

This is not the case in the cited references. In the cited references, different gases are fed individually into different portions of the chamber and in some cases the gases are only fed into one region of the chamber. As a result, process variations may be produced during processing. Furthermore, their systems are much more complex and likely to send to much gas (or are actually set to prevent the ability to send to) a single gas outlet. Their systems are set to prevent mixing or they have independent controls so their gas mixture

setting MFCs are all driven independently with reasonable pressure drops across them. If they put all their flows together, their MFCs would have very little pressure drop across them and fail to control and hence lead to failure to control the mixture of the total flow. Moreover, the references do not describe azimuthally symmetric distribution of gases.

In brief, *Li* (6070551) feeds multiple gases individually and is all about being able to deliver different mixtures. In contrast, the present invention feeds a single mixture thereby always ensuring the same mixture is fed to the different regions.

Muregesh (6228781) is all about delivering different gases, purging, managing cleaning, etc. They have many flow controllers 35A-A', 35B-B', etc. that go to multiple areas thereby making it very difficult to perform key element of the present invention, i.e., adjusting the gas ratio with a sure identical single mixture.

Collins (6024826) teaches seven independent gas supplies, which is very complex and difficult to control. In contrast, the present invention feeds a single mixture thereby always ensuring the same mixture is fed to the different regions. In addition, *Collins* does not teach rationing to different regions.

Li (6009830) mixes gas inside delivery lines and needs to set individual flows into the delivery lines to set ratio. Mixture and sub-total flow set by 68/72 goes to 56-54 while user must independently specify another mixture and total flow set by 70/74 going to 52/38 to ensure ratio of same mix with sum total gas delivered. In contrast, the present invention makes it easy to use a standard gas box with a bunch of MFCs to set a single gas mixture with a single sum total flow (sccm) that is then split by setting a single ratio to two different portions of the chamber.

With regard to the new references, *Fujii* does not deliver the same gas to two different regions. *Fujii* only delivers gas to a top region. Furthermore, the pipes are not azimuthally symmetric, but rather inline (see Fig. 7). *Fujiyama* discloses gas emitting tube 4 and gas emitting ring 9 that emit different gases at different times and thus the flow of a single gas is not controlled or rationized to two different regions. *Yamakazi* does not deliver gas to two different regions, and further does not control or rationize the exiting gases. In all three references, azimuthal symmetry is not described.

It should be pointed out that each of these references discloses a gas system that should be taken in totality. Pieces should not be taken from one and added to another. Each of these systems is a system and therefore the addition of another element would surely effect the proper functioning of the system in a non-trivial manner. One skilled in the art would simply not be motivated to combine the teachings of the various components of

these systems to come up with the claimed invention. Furthermore, it is believed that the motivation to combine should come from something other than the fact that these are gas systems since each of these gas systems operates in a substantially different manner.

Other

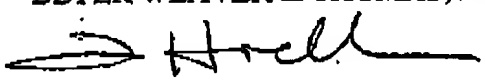
In one argument, the Examiner asserts on page 5 of the office action that Li '830 "discloses the use of gas rings in an upper peripheral region (gas ring 38)", and then in another argument the Examiner asserts on page 10 of the office action that Li '830 "discloses a gas distribution plate 38 at the top central portion" These are contradictory of one another since the top central region and the upper peripheral region are different. The Examiner cannot interpret this both ways.

SUMMARY

Applicants believe that all pending claims are allowable and respectfully requests a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at the telephone number set out below.

Respectfully submitted,

BEYER WEAVER & THOMAS, LLP



Quin C. Hoellwarth
Reg. No. 45, 738

P.O. Box 70250
Oakland, CA 94612-0250
(650) 961-8300